US005377281A

United States Patent [19]

Ballard et al.

[11] Patent Number: 5,377,281

[45] Date of Patent: Dec. 27, 1994

[54] **KNOWLEDGE-BASED CHARACTER RECOGNITION**

[75] Inventors: **Bruce W. Ballard**, Durham, N.C.; **Mark A. Jones**, New Providence, N.J.; **Guy A. Story**, New York, N.Y.

[73] Assignee: **AT&T Corp.**, Murray Hill, N.J.

[21] Appl. No.: **853,559**

[22] Filed: **Mar. 18, 1992**

[51] **Int. Cl.**[5] **G06K 9/72**

[52] **U.S. Cl.** **382/40**; 382/36; 382/37; 382/39; 382/57

[58] **Field of Search** 382/14, 40, 39, 37, 382/57, 36

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,969,700	7/1976	Bollinger et al.	382/40
4,058,795	11/1977	Balm	382/40
4,654,875	3/1987	Srihari et al.	382/40
5,133,023	7/1992	Bokser	382/40
5,161,245	11/1992	Fenwick	382/40

OTHER PUBLICATIONS

J. J. Hull and S. N. Srihari, "Comparison of Two Contextual Post-Processing Algorithms for Text Recognition," IEEE, 1982, pp. 146–151.

J. J. Hull, S. N. Srihari and R. Choudhari, "An Integrated Algorithm for Text Recognition: Comparison with a Cascaded Algorithm," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. PAMI-5, No. 4, Jul. 1983, pp. 384–395.

S. N. Srihari, J. J. Hull and R. Choudhari, "Integrating Diverse Knowledge Sources in Text Recognition," ACM Transactions on Office Information Systems, vol. 1, No. 1, Jan. 1983, pp. 68–87.

S. N. Srihari, J. J. Hull and R. Choudhari, "Integration of bottom-up and top-down contextual knowledge in text error correction," National Computer Conference, 1982, pp. 501–508.

M. A. Jones, G. A. Story, B. W. Ballard, "Integrating Multiple Knowledge Sources in a Bayesian OCR Post-Processor," ICDAR-91 Conference Proceedings, St. Malo, France, Summer 1991, pp. 925–933.

Primary Examiner—David K. Moore
Assistant Examiner—Phuoc Tran
Attorney, Agent, or Firm—Henry T. Brendzel

[57] **ABSTRACT**

Character string recognition and identification is accomplished with a combined, multi-phase top-down and bottom-up process. Characters in an applied signal are recognized with a process that employs a knowledge source which contains information both, about the basic elements in the signal and about strings of the basic elements in the signal. The knowledge source, which may be derived from a training corpus, includes word probabilities, word di-gram probabilities, statisitics that relate the likelihood of words with particular character prefixes, and rewrite suggestions and their costs. Higher level word n-grams, such as word trigram probabilities, can also be used. A mechanism is provided for accepting words that are not found in the knowledge base, as well as for rewrite suggestions that are not in the knowledge base.

29 Claims, 6 Drawing Sheets